FM Remote Control Receiver

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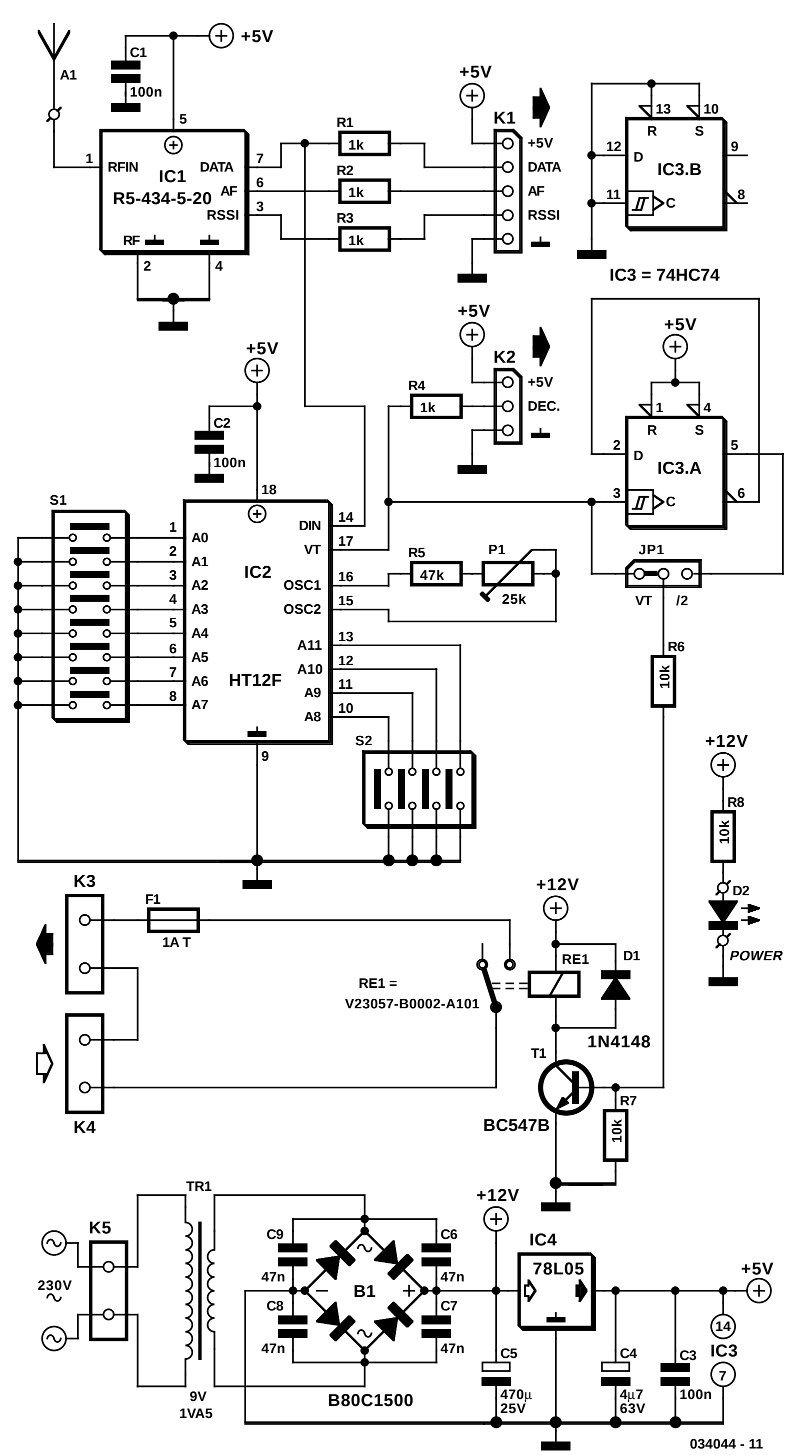
It is often required to switch electrical appliances from a distance (the garage light, when you're still in your car for example) without there being a direct line of sight between the transmitter and receiver. This rules out the use of infrared, so we have to use radio signals instead. An ideal solution for this application is provided by transmitter and receiver modules, which operate at a frequency of 433 MHz and are available ready-made. This circuit complements the small FM transmitter that uses such a module. Here we describe the associated receiver, which picks up the transmitted signals using an R5-434-5-20 receiver module made by R.F. Solutions (this 20 kbps version is now also stocked by Farnell). This integrated receiver has been tuned to a frequency of 433.92 MHz, exactly the same as for the transmitter.

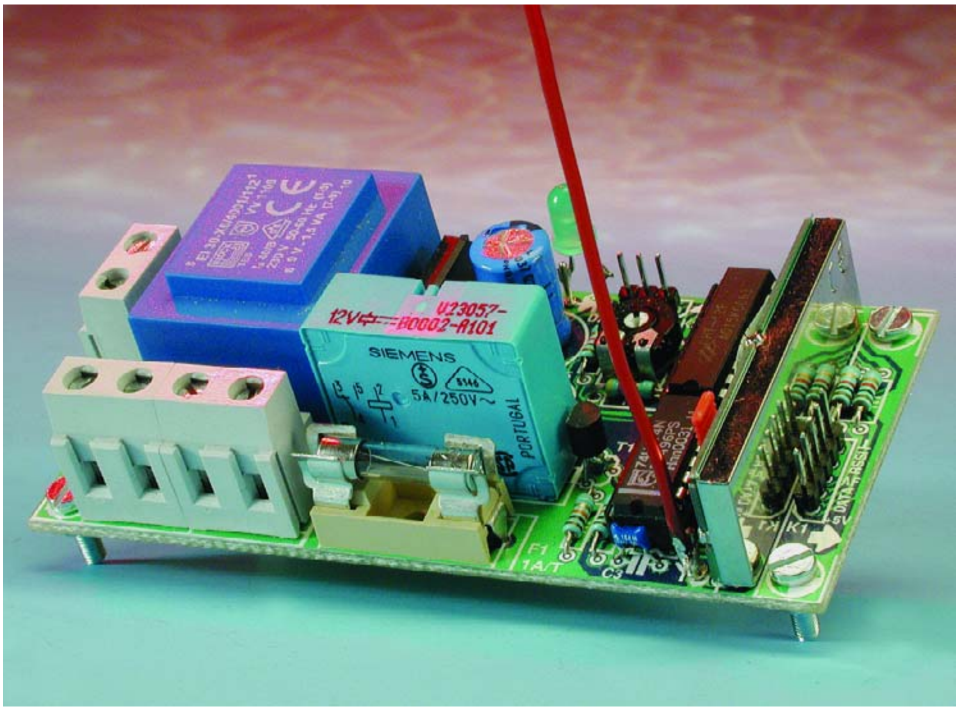
To prevent interference and unauthorised use the transmitter sends out a coded signal. This is processed in our receiver by decoder IC HT12F, made by Holtek. P1 and R5 are used to tune the oscillator frequency of the decoder to that of the encoder in the transmitter. In this way any possible variations due to tolerances or a different battery voltage can be compensated for by P1. The data bits are set up using solder bridges on the PCB (S1 and S2).

With jumper JP1 the output can be diverted through a divide-by-two circuit (half of IC3, a dual D-type flip-flop 74HC74), so that relay RE1 can remain energised without the presence of a signal. The make contact of the relay connects a contact of terminal block K4 to K3 via a fuse. The other contacts are connected directly. The relay and terminal blocks are placed far enough from mains voltages on the PCB to comply with Class II safety specifications. It is also possible to connect terminal block K4 with K5 in order to safely switch mains voltages. In this case you should make sure that the 'live' mains voltage is connected via the relay and fuse.

The circuit has a mains power supply on-board, making it ready for use as soon as the construction is complete. The relay and mains power indicator are driven directly from the smoothed transformer output, keeping the load on the small 5 V regulator (78L05) to a minimum. It should now only have to supply a few mAs.

The use of a ready-made receiver module simplifies the construction of this circuit and also makes it more reliable. Apart from the RF input (RF IN) the module has a data and analogue output (AF). There is also a status output that gives an indication of the RF signal strength (RSSI). These last two signals are not used in this application. There is another article in this issue (Amplifier with Squelch), which uses these two analogue signals with an extra circuit and a modified version of the transmitter. For this reason all outputs of the receiver module have been made available on a 5-way pin header (K1), along with the supply volt-





age. R1 to R3 protect the outputs from potential short circuits. The supply on this header is only meant to provide a few mAs!

Just as for the transmitter, the aerial has to be mounted as close as possible to the 'RF IN' pin. The construction of the aerial is described in the article for the transmitter. The output of the decoder (as well as the supply voltage) is brought out on a separate pin header (K2), making the logical signal available to circuits that need it.

The transmitter and receiver PCBs have been combined on one board to keep the cost down. The small transmitter section can be cut easily from the board. The remaining receiver PCB is well-organised and easily populated (don't forget the wire-link underneath IC3!). It is possible that jumper JP1 may be a tight fit between IC3 and receiver module IC1. All connectors have been placed along the edges of the PCB. If you make a connection to K1 you should take care that you don't make contact with the metal shielding of the module.

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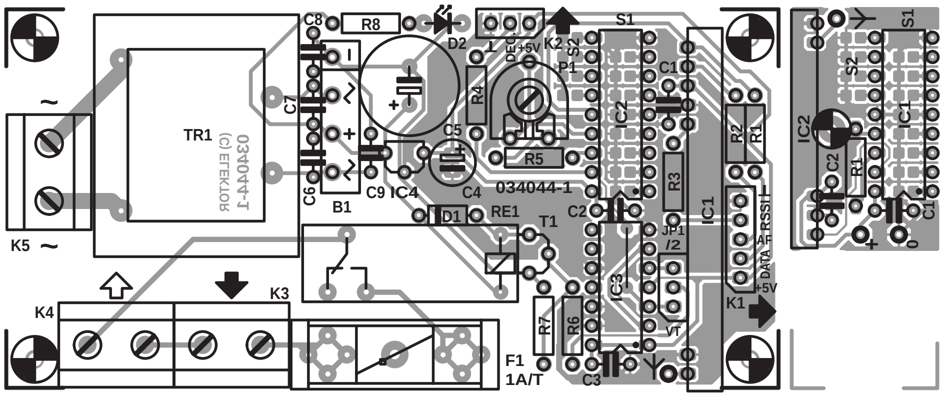

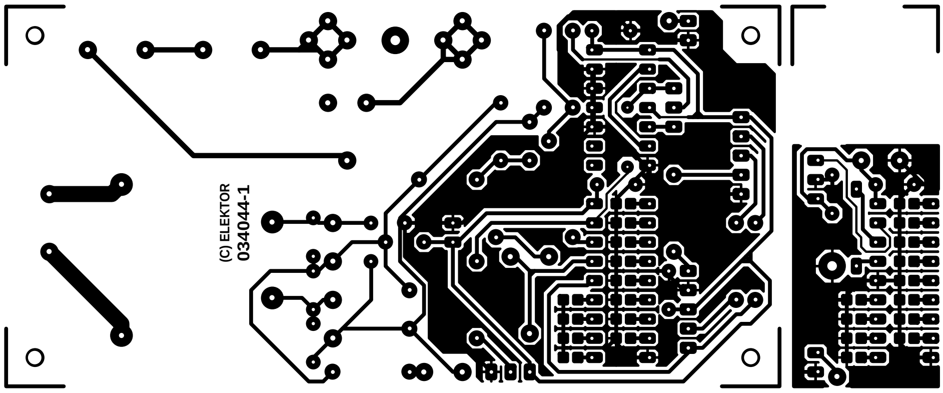

COMPONENTS LIST

Resistors:
R1-R4 = 1kΩ
R5 = 47kΩ
R6,R7,R8 = 10kΩ
P1 = 25kΩ preset

Capacitors:
C1,C2,C3= 100nF ceramic
C4 = 4µF7 63V radial
C5 = 470µF 25V radial
C6-C9 = 47nF ceramic

Semiconductors:
D1 = 1N4148
D2 = LED, high-efficiency
T1 = BC547B
IC1 = R5-434-5-20 from R.F. Solutions (Farnell # 352-4383)
IC2 = HT12F from Holtek (Maplin)
IC3 = 74HC74
IC4 = 78L05

Miscellaneous:
JP1 = 3-way pinheader with jumper
K1 = 5-way pinheader
K2 = 3-way pinheader
K3,K4,K5 = 2-way PCB terminal block, lead pitch 7.5 mm
S1,S2 = solder links
B1 = B80C1500 (rectangular case) (80V piv, 1.5A)
TR1 = mains transformer, 9V/1.5VA, e.g., Block type EI30-X6/4001/112 VV1109
F1 = fuse, 1AT (time lag), with PCB mount holder
RE1 = V23057-B0002-A101 vertical card relay 12 V/330 Ω/ 8 A
PCB, order code **034044-1** (transmitter and receiver)